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Forensic Document Examination Tools used to Boost Land Fraud Investigation at the dci Headquarters in Nairobi City County, Kenya

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Abstract

Many countries in the world recognize that forensic document examination is vital to fraud document detection and mitigation. They therefore, have forensic document examination facilities. Although the ability to detect and disseminate intelligence about fraudulent documents is vital to security, there are still countries lacking this capacity, and specifically on land fraud investigation. Therefore, the purpose of this study was to examine the forensic document examination tools used to boost land fraud investigation at the DCI headquarters in Nairobi County, Kenya. The study was guided by the routine activity theory. The research design for this study was based on a case study research design. Purposive sampling was employed to establish the suitable respondents while simple random sampling technique was used to select the particular respondent. Questionnaires and interview schedules were utilized

to collect primary data from the sampled respondents. Both qualitative and quantitative data were triangulated to provide robust key findings. The findings of the study revealed that, magnifiers and microscopes, comparison devices, Ultraviolet and infrared lamp and electrostatic detection apparatus were the most used tools. The study concluded, that forensic document examination though not motivated by profit making plays a significant role that enhances state capacity in provision of documents security as well as contributes to safety of citizen's assets. Based on the findings, the study recommended the department should be well funded by the government and other stakeholders so that it can be able to sustain and achieve its best practices.

Keywords: Forensic, Document, Examination, Document Expert, Land Documents, Fraud

1. Introduction

The land is an important source of human energy, like as air and water, sustaining every aspect of human lives, providing fundamental life-support system and the foundation of our economy and society. Its legitimacy, is guaranteed by the land documents which are the legal documents that proves ownership of land and legal rights to it. Land documents includes an official title deed, or a certificate transferring land from an entity to another. But the sizes of land have greatly been reduced by the rapid increase in human population, especially in developing countries. According to Exner *et al* (2015) ^[5] this new phenomenon has created a series of problems including the need for agricultural land to be expanded and land replenished for the purpose of resettlement and reconstruction. And due to that, it has led to an increase in land-related crimes such as interfering with land boundaries and beacons, trespass, land documents fraud and forgery.

The Law Society (2021) ^[20] defines land/title fraud is where a criminal steals a property owner's identity and changes the property title from the owner's name to theirs. For instance, an individual may attempt to sell a property that does not belong to them. In this situation, an individual will pretend to be the rightful owner of the property.

According to Legal Match (2021) ^[13], land fraud typically occurs when an individual uses tactics of deceit, fraud, or misrepresentation in order to gain a benefit or make a profit off of entering into a land contract deal. Such as, an individual may misrepresent that they are the actual owner of a property and provides fraudulent title documents to that property, such as a deed. Unfortunately, although the practice and technology are upgraded to provide for the current needs, the attempts on unrestrained crimes in the land management practice are unavoidable. The increase of fraud in land dealings has triggered uneasiness among registered proprietors since the exclusive ownership of their lands may easily be converted without notice. Consequently, the aftermath can be significant with critical loss of confidence in the property market and the credibility of land-related transactions.

Fraud and use of counterfeit documents to obtain land has become common and consequently a big threat to land owners and national security. The need for document examination knowledge is essential to deter this threat. Forging official land documents is considered the highest forgery offense in most national legislations, with the intent of selling it as an aggravating factor (Khaton, 2020) [9]. Depending on the situation, the type of document forged and the intent behind it, the offense and related penalties can differ. The law recognizes the importance of detection of fraud of disputed land documents in the prosecution of a crime or administrating or justice. When scientific methods are used improperly, without bias or favoritism, they can provide conclusive evidence in revealing and proving authenticity to land documents. One such scientific method used in detection of fraud of disputed land documents is the forensic document examination.

Forensic document examination is a daily practice since the use of documents is part of daily life, investigating the authenticity of documents in situations such as alterations, forgeries, page substitutions, identity theft, and counterfeiting are a part and parcel of life. According to Songer (2015) [18] Forensic Document Examination (FDE) is a forensic science discipline in which expert examiners evaluate documents disputed in the legal system. Forensic document examination is scientific with the main objective of gathering evidence from questionable documents potentially disputed by the handling authority. Very crucial information can be gathered from questionable documents related to the document holders. Different methods may be used to collect evidence from questioned documents. Evidence may include forgery, authenticity, alterations, damage to the document, the legality of the document, or any other suspicions that can be connected to the documents that can be challenged by the concerned authorities.

The Forensic document examination (FDE) expertise process has been used for many years and has been instrumental in border controls and airports to detect fraudulent travel documents around the world. FDE expertise has also been used in white criminal cases and is used to support investigations into cases such as cheating checks, wills, car documents, banks and other related documents, documents and economic related documents (Durina, 2020) [4]. There is an increase in knowledge and skills due to modern technology that has led to better use of forensic technology to resolve disputes in a court of law. Therefore, the main principle of FDE is to determine the authenticity of documents including the land documents. Examiners determine whether documents are genuine by confirming who created the document, identifying the materials used, or uncovering modifications done by fraudsters. They may also examine for evidence of alterations, obliterations, erasures, and page substitutions.

Document examination knowledge plays an important role in the criminal justice process. According to Angel and Seaman (2020) [1], the main purpose of the forensic document examination is to determine the authorship or non-authorship of the disputed and collected documents. Every document has physical features and compositions that can be exploited by scientists to understand how and why a document was created, who created it, and whether or not the document can serve as proof that a crime was committed. Forensic document examiners are educated and trained in the arts and sciences of testing questioned documents for both criminal and civil justice purposes.

In the USA, the analysis and interpretation of land evidence are the domain of forensic land examiners (Stern, 2017) [19]. Forensic land examiners summarize their findings in a report that is used in the investigation and may be presented at a trial. According to Stern (2017) [19] forensic land evidence is very powerful in the courtroom settings, but several recent events have raised questions about the scientific foundation underlying the analysis and interpretation of forensic evidence. This is because, unreliable and improper forensic science has been a contributed to several cases of improper convictions. And this is an identified challenge associated with this practice of forensic science. This raised the question as to the influence of forensic land examination tools on the document

fraud investigation of the USA.

In the Russian Federation, the effectiveness of the protection of land rights depends on the time for the expert examination, selection and qualification of an expert. Land disputes take longer to be resolved by the courts due to the duration of the examination and lack of documents for examination (Kozlova & Golyakova, 2019) [12]. But forensic land examiners are an indispensable and unique source of factual information that executed with patience, as without which it is almost impossible to handle cases involving land frauds and disputes. Kozlova and Golyakova (2019) [12] continue to state that, land document resolution expertise in the Russian Federation is carried out in 3 stages (preparatory, experiment and final), during which the expert evaluates the circumstances of the case, examines the object of examination, conducts field work and forms an expert opinion. Therefore, forensic examiners are valuable experts in this field in the Russian Federation and it is necessary to support the development and improvement of their professional activities in various ways. Forensic document examination in Russian Federation appears to be used to enhance land disputes resolutions, but there is a dearth of knowledge on how forensic land examination tools influence land fraud investigation.

In Nigeria, financial crimes in ministries, departments and agencies could also be reduced with the utilization of forensic examinations techniques, such as document auditing (Appah & Inini, 2021) [2]. They further noted that these techniques could be applied to decrease the level of public sector financial crimes in Nigeria. Hence, the employment of forensic document examinations techniques is being employed to reduce financial crimes in the Nigerian public sector. But there is a dearth of knowledge on how forensic land examination tools would influence land fraud investigation in Nigeria.

In Kenya, the Kenyan Government has invested in forensic science development by putting up forensics' infrastructures such as the building of modern forensic laboratories at DCI Headquarters and the recruitment of more forensic experts to work in these laboratories. A study conducted by Mbaya (2016) [14] on the state of forensic investigations in Kenya established, that forensic document examination in Kenya is low, for the following reasons; weak framework, absence of a standard system to be followed, and nonappearance of strategies concerning forensic investigations. This could imply that some of the cases being prosecuted by the DCI are being dismissed for lack of sufficient grounds for prosecution, thereby it created a need to study the impact of forensic document examination tools on land fraud investigation.

Further, Ogutu and Ngahu (2016) [15] conducted a study on the application of forensic auditing skills in fraud mitigation: A survey of accounting firms in the County Government of Nakuru. The study identified five areas that needed forensic document examination that included, fraud prevention and detection at 97%, bankruptcy, insolvency and reorganization at 79.4%, financial statement misrepresentation at 76%, economic damage calculations (57.6%) and family disputes at 53%. But it fell short in providing a holistic explanation on how forensic document examination tools informs land fraud investigation.

Kipngetch (2021) [11] conducted a study on the Determinants of forensic science application in criminal investigation at the Directorate of criminal investigations in Nairobi City County. The study showed that, forensic document examination in Kenya have generally been marred with challenges from the unavailability of forensic tools, level of training on the officers' conducting investigations, unavailability of resources such as forensic labs, and inadequate laws and policies governing the application of forensic science in Kenya. Therefore, the need to understand how forensic document examination tools influences land fraud investigation provided the impetus for this study.

In Kenya, DCI forensic document examination unit has not been at its best as the unit is not autonomous and document experts have not in many cases delivered appropriate evidence which have integrity due to its lack of capacity of skilled people in the field (Khaton, 2020) [9]. The DCI officers have been short of adequate

training within the country since no institution of higher learning offers training specifically on document examination. According to Behrendt and Nguyen (2018) [3] developing countries depend on sponsorship by developed countries for training to enable them give credible evidence that can be relied upon by courts. Hence the budget constrain that cannot facilitate adequate training abroad and overseas have contributed too. This has resulted to the DCI document examination unit giving wrong evidence and land fraud cases increasing in the recent past and most of them being unresolved (Khator, 2020) [9]. In other cases, experts lack modern equipment's to analyze disputed documents and get crucial evidence that can be admissible in court. This has resulted to many criminals and land grabbers go scot-free in many trials and/or family losing properties worth millions of shillings to fraudsters hence denied justice.

This has had been a challenge in instilling confidence in clients and other stakeholders that the DCI and the entire Criminal Justice System is conducting itself efficiently and to a high standard. Therefore, this study aimed to investigate what constitute the appropriate forensic document examination tools which will lead to an appropriate delivery of justice to the victims of land grabbing. This study analyzed the efficiency of the forensic document examination tools within the DCI headquarters in solving land fraud related crimes.

2. Materials and Methods

The study adopted a case study research design approach in data collection. The study was conducted in Nairobi City County. It is on a 269 square meter (KNBS, 2016), and is one of the 47 counties of Kenya founded in 2013 after promulgation of the new Kenyan constitution (Appendix VII). Nairobi is home to the headquarter of the Directorate of Criminal Investigation in Kenya, where all the document forensic examiners are housed. Therefore, it has the most diverse experiences of forensic document examination and land fraud investigation. All these factors have informed the choice of Nairobi as a study area. The target population for this research consisted of practitioners in forensic document examination under forensics at the Directorate of Criminal Investigation. The unit of analysis was the individual forensic document examiners. The study population consisted of 34 forensic document examiners, 4 team leaders the rank of senior superintendent and the director forensics.

The researcher used purposive sampling to get the sample size and to identify the particular respondents by simple random sampling. Then simple random sampling technique was used in selecting that particular participant. First, 34 forensic document examiners, 4 team leaders the rank of senior superintendent and the director forensics were purposively sampled (that is 100% of the total target population) because they had the particular characteristics of forensic document examination that are of interest, which best enabled the researcher to answer the research questions.

Secondly, 30 out of 34 document examiners, were also sampled random selected, and 4 team leaders the rank of senior superintendent and the director forensics were purposively sampled for the scheduled interview. Guest *et al* (2006) [7] recommends 20% of an *n* compared to the general *N*. However, the researcher increased to 89.7%, as stated by Baguley (2004) who argues that the statistical power is enhanced by increasing the sample size.

Table 1: Sampled Respondents

Respondents	Total	Sample
Director	1	1
Team leaders	4	4
Forensic document examiners	34	30
Frequency	39	35
Percentage	100	89.7

The study used 35 respondent which was 89.7% of the total target population. The study used structured questionnaires and scheduled interviews. Questionnaires had both closed and open-ended

questions. The questionnaires were administered to the 20 document examiners sampled randomly, with the help of research assistants. Participants were allowed to complete the questionnaires themselves.

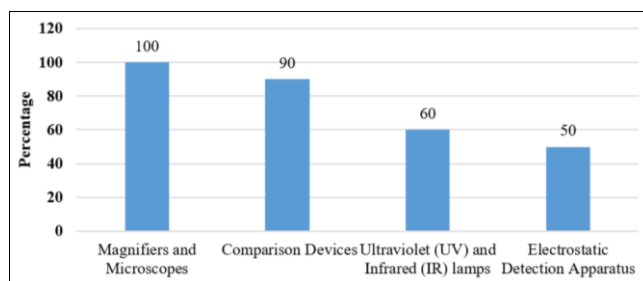
On the scheduled interview guide, one-on-one interviews were conducted with the sampled 4 team leaders the rank of senior superintendent and the director forensics. Interviews guides gave room for further probing to expound and clarify on any response from the respondents.

Both quantitative and qualitative methods were used in the data analysis. The data from both qualitative and quantitative analysis was triangulated to see the influence of examine forensic document examination on land fraud investigation.

The authority to carry out the study was sought from the Directorate of Criminal Investigation, and also the National Commission for Science, Technology and Innovation (NACOSTI) where a Research Authorization Permit was obtained. The researcher informed all participants through a covering letter of their voluntary participation and confidentiality of the information they give. Thus, an informed consent was sought from all respondents. All the photos that were used in the project, were with the consent of the organization and people in them. And they were taken after their participation in the study.

3. Results and Discussion

Experts show that forensic document examination tools involved in conducting land fraud investigation are wide in range: - Handwriting Page, Indented Impression Examinations, Paper Cuts, Tears and Perforations, Alteration, Obliteration, and Erasure Examinations, Facsimile TTI and RTI Examinations (Indiana State Police, 2021) [8]. These tools have two objectives: to make solve the fraud cases as fast as possible and to provide convincing, truthful evidence for the criminal Justice System. Therefore, it was important to examine the level of utilization of these tools. To establish the level of utilization of these tools, the participants were asked to mention and comment on which forensic document examination tools they are using or have you ever used. The results are displayed below (Fig 1).



Source: Field Data (2023)

Fig 1: The Forensic Document Examination Tools Used When Conducting Land Fraud Investigation

As can be observed from the figure, majority of participants indicated magnifiers and microscopes as the most used at n= 35 (100 %), followed by comparison devices at n=31 (88.6 %), in the third distant position is Ultraviolet (UV) and infrared (IR) lamp represented by n= 21 (60 %), and lastly, electrostatic detection apparatus represented by n= 17 (48.6 %). These findings are summarized in the Fig 1 above.

a) Magnifiers and Microscopes

Magnifying glasses and microscopes, are commonly used in most laboratories. They are optical devices used for viewing details of objects with amplification. These optical instruments consist of one or more lenses in order to magnify images of miniature objects. The high usage of the magnifiers and microscopes is due to fact that all documents will be magnified for clear visibility. One of the document examiners interviewed explained.

“Magnifiers, including handheld magnifiers and microscope magnifiers, are used to enlarge small details of a document so that they can be more easily studied. This is particularly useful for examining handwriting and other small features of a document” (RESP1/7/2023)

Another document examiner respondent had this to say...

“Those tools for example the stereomicroscope, have broadened our understanding of nature, enabling us to see in great detail what we otherwise would not see at all” (RESP2/7/2023)

This is an indicator that, the use of magnifiers and microscopes have worked so well that they have become the foundation of great advancement in science, especially in forensics and investigations. Handheld magnifiers come in handy for simple tasks like reading a book, newspapers, checking a tag or a map and other documents with fine print.

A handheld magnifying glass (called a hand lens in laboratory contexts) is a convex lens that is used to produce a magnified image of an object. Magnifying glasses mounted in reading devices that can magnify print from three to 10 times while desktop magnifiers commonly known as Microscopes can provide magnification from 5 times to 60 times its normal size. These non-portable devices are typically larger and are placed on the surface of a table or desk, or in one fixed location. They are used for reading the pages of a document by professionals who scrutinize faded or unclear writings on documents. Such include land documents like title deeds or sale agreements which seem to have been altered or that had been kept in under good conditions for the writing/prints to be illegible. They are also able to assist in the detection of alterations of prints. This is because they have additional features, such as a built-in light system that provides a greater level of detail and facilitates reading in dark environments can also increase accuracy.



Source: Field Data (2023)

Fig 2: Hand held Magnifier



Source: Field Data (2023)

Fig 3: Microscope with Accessories

As captured in the pictures in Fig 2, a hand-held magnifier and Fig 3, is a desktop magnifier displaying its magnification on a desktop monitor for accuracy of land fraud investigation at the DCI headquarters.

Different types of microscopes provide different properties and aids. The types of microscopes indispensable in forensic investigations are stereomicroscope, comparison microscope and scanning electron microscope. A stereomicroscope gives a three-dimensional view of documents. It is particularly useful for examining small or delicate objects that may be damaged by other types of microscopes, such as electron microscopes hence its preference in forensic science to examine evidence. This study corroborates Thakur (2021) [17] who stated that stereomicroscope is a type of microscope that is indispensable in forensic investigations. And that microscopes are used in various fields of forensic science including forensic criminal science, forensic anthropology, forensic epidemiology and forensic pathology. Their usage positively influences land fraud investigation, as the examination of forensic documents is highly enhanced.

b) Comparison Devices

Comparison devices, including comparison microscopes and side-by-side view boxes, are used to compare documents or handwriting samples side by side. This helps the examiner to determine whether two documents were written by the same person or for identifying differences between handwriting samples and make conclusions on the observations. The high usage of the comparison devices is due to fact that most documents will be subjected for originality assessment. The usage of the comparison devices, is demonstrated by their capability to respond to the needs of the forensic examiners as depicted in this excerpt.

“There are so much handwriting comparisons of photocopied writings, original questioned signatures and on the same signatures that had been photocopied. Therefore, comparison devices like the video spectral comparator come in to use to assist in this endeavor” (RESP3/7/2023)

The respondent acknowledged the usefulness of the comparison devices as a forensic document examination tool that detects documents or handwritings. A video spectral comparator (VSC) is a type of forensic document examination tool that is used to compare the spectral (shade) characteristics of two samples of handwriting or other written materials in order to determine whether they were written by the same person. The VSC works by using a video camera to capture images of two samples, which are then analyzed using specialized software to compare the spectral characteristics of the samples. The VSC is typically used in forensic document examination to determine the authenticity of land documents or to identify the author of a land document. It can be used to compare handwriting, printing, or other types of written marks, such as signatures or symbols.

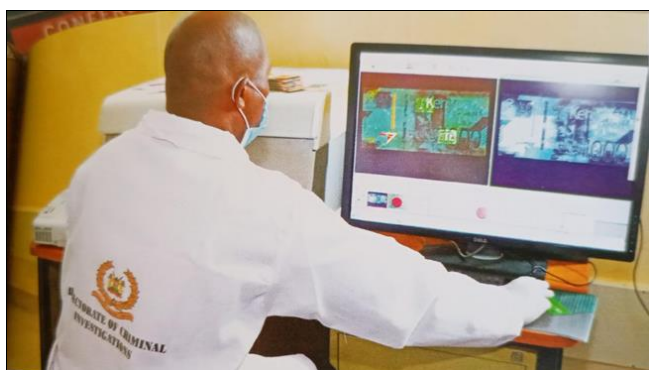
Forensic handwriting identification by the comparison devices such as the VSC, is a scientific examination and comparison of handwriting primarily for the purpose of identifying the author of a known or an unknown sample. The questioned writing are done by a known or an unknown writer whose identity must be determined by the use of by the comparison devices. The questioned writing is analyzed of the many handwriting characteristics and features of a questioned or unknown sample of handwriting or printing and a comparison of these features with those of a known sample of handwriting or printing from a suspect.

When working with land document photocopies, the best evidence for examination purposes is always the original land document, but frequently only a photocopy is available. If it is necessary to examine a land photocopy, the best copy for examination purposes is one made from the original land document and not a copy of a copy.

The purpose of fabricated land documents is to offer them as proof of a position in a dispute, to justify a position, or to take some

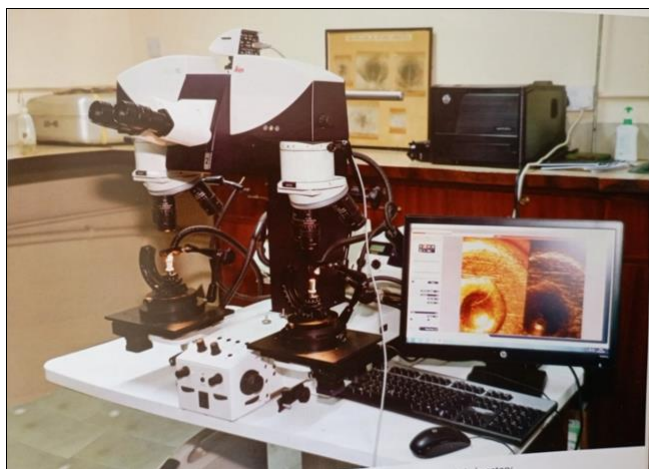
action. Increasingly, the authenticity of photocopied land documents is being questioned because of the ease with which fictitious land documents are created to make it appear that the original land document contained certain text or even a signature. The only way to substantiate that a copy is an accurate reproduction of the land document it purports to represent is by comparing the copy with the original. Photocopies typically do not reveal all the evidence found on the original document or document being copied, for instance, indentations, pen stops or alterations. A photocopy can also contain items not on the original land document. These items may be dirt, dried white-out, or scratches.

The most important thing to remember in the comparison of land documents is that the opinion expressed after the examination by the comparison tools like the VSC, applies only to the observable evidence on that copy. Similarly, Durina (2020) [4] had argued that the comparison devices as a forensic document examination tool in lands document examination to avoid errors regarding authorship made for original or photocopied signatures, so as there are no instances where an identification/elimination opinion is reversed between a land document photocopy and its original. Also, this is in line with Found, *et al.* (2018) [6] who stated that, forensic document examiners are able to make comparisons on a complex document with the same accuracy and similar sensitivity when using either originals or photocopies by use of comparison devices. As captured in the pictures below are, Fig 4, is a Video Spectral Comparator displaying its magnification on a desktop monitor for accuracy of land fraud investigation at the DCI headquarters.



Source: Field Data (2023)

Fig 4: A Forensic Document Examiner on a Video Spectral Comparator



Source: Field Data (2023)

Fig 5: Video Spectral Comparator

c) Ultraviolet (UV) and Infrared (IR) Lamps

Ultraviolet (UV) and infrared (IR) lamps, are all types of a broad spectrum of light or rays. The human eye can only detect only a small portion of this spectrum called visible light. Infrared light has

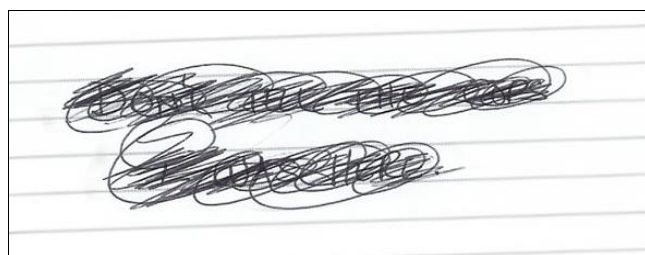
a longer wavelength than visible light, and it is not visible to the human eye. Ultraviolet light has a shorter wavelength than visible light, and it is also not visible to the human eye. But they are often used in applications like imaging applications and thermal imaging cameras. They were the third most used tool at 60% and it was therefore imperative to examine their usage by the respondents. A respondent had this to say.

“Ultraviolet lamps and infrared lamps allow us forensic investigators to examine clues and recover evidence that could not have been previously detected by our naked eyes. Both lamps provide more detail and contrast to mark areas than standard lighting techniques” (RESP4/7/2023)

Another document examiner respondent explained...

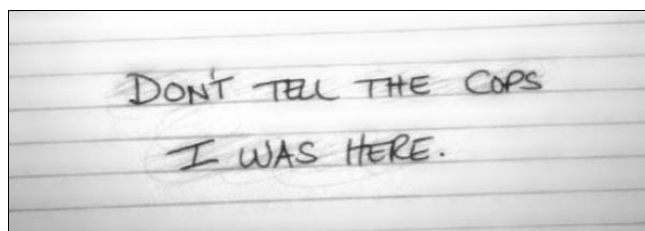
“They are used in documents containing security features like money and passport” (RESP5/7/2023)

Photographs done with these techniques show markings in greater detail than would be possible with conventional photographic equipment. They reveal images of markings that could not be seen by the naked eye. Ultraviolet lamps and infrared technology can also be used to scan a document for evidence not detectable by the naked eye. The resulting images are displayed on a video screen within the device which can be linked to other video equipment, such as a standard video cassette recorder, a graphics computer, or a conventional camera for still photographs.



Source: <https://www.forensicsciencesimplified.org/docs/how.html>

Fig 6: Obliterated note viewed with visible light



Source: <https://www.forensicsciencesimplified.org/docs/how.html>

Fig 7: Same note viewed with infrared radiation

Use of the monitor screen and/or a video cassette recorder, allows the forensic document examiners to visualize an ultraviolet image immediately without waiting for film to be developed. Documents alterations, where original script has been tampered with for instance with inks, it helps in visualizing the differences seemingly identical to the naked eye. Also, dyes and other pigments brightness when exposed to infrared stimulation may be identified by their degree of luminescence. Therefore, forensic document examiners can reveal the writing in case of chemical erasures.

Ultraviolet (UV) and infrared (IR) lamps are used to examine documents for features that are not visible under normal lighting conditions. UV lamps can be used to reveal hidden writing or alterations on a document, while IR lamps can be used to reveal watermarks or other security features on paper.

At the DCI, **Docucenter NIRVIS** with its excellent optics, high resolution digital camera, fully controlled working sequences and functions permit investigations to determine the degree of luminescence. It is used in the analysis and examination of

questioned documents like title deeds and sale agreements. In the Fig 8 below, the integrated color spectroscopy module permits spectral comparison investigations.



Source: Field Data (2023)

Fig 8: Docucenter NIRVIS a combined (UV) and (IR) lamp



Source: Field Data (2023)

Fig 9: An infrared (IR) lamp

Land documents may be altered by erasing or obscuring writing, or by changing, extending, or adding text or signatures. Erasures are often easily detected by visual examination, and even writing erased through a chemical solvent may leave stains that are visible under UV and IR lamps. They may also result in roughened or disturbed paper fibers and impressions of the original writing, and ink written over erased areas tends to bleed slightly and spread. Obliterations or overwriting which is the blocking out of portions of writing using some opaque material, also may be used to obscure writing or other information on the questioned document. Although this is a fairly crude and obvious way to alter a document, it may fall to the forensic document examiner to attempt to decipher what was obscured. It is sometimes possible to remove the obliterating material using an ordinary rubber eraser, chemical solvent or scraping off the overlying layer, although pains must be taken not to damage the underlying writing.

The use of UV and IR lamps (Fig 9) may be useful in helping examiners to differentiate the original writing from the covering material as well. Markings not visible to the naked eye due to obliterations, erasures and alterations often can be recovered through the use of photography and other imaging techniques that utilize ultraviolet or infrared lamps. For example, UV and IR lamps filter, combined with other light sources, causes ink that has faded over the years to be enhanced and therefore legible.

The study found that UV and IR lamps can be a simple and effective means that does not destroy evidence, but allows for further testing if required. Polak *et al* (2017)^[16] and Khumalo and Bhebhe (2018)^[10] had also observed that, forensic document examination has undergone significant development and that there is an increase in UV and IR lamps technologies that with different configurations provide many ways to obtain higher resolution images. And that, it allows for fast production of clear information that is used to compare to original documents.

d) Electrostatic Detection Apparatus (ESDA)

An electrostatic detection apparatus (ESDA) was mentioned as the least used forensic tool at 50%. The ESDA is used to detect and

visualize latent (invisible) impressions on documents or other types of paper-based evidence. The ESDA works by using an electrical charge to reveal indentations or other types of pressure marks that may have been left on the paper by writing or printing. The ESDA consists of a flat, transparent plate that is mounted on an electrical charging device, and a sheet of carbon paper or other type of electrically conductive material. The carbon paper is placed on top of the transparent plate, and the document or other piece of paper is placed on top of the carbon paper. On electrostatic detection apparatus, a forensic document examiner respondent pointed out that.

“When the ESDA is activated, an electrical charge is applied to the transparent plate, causing the carbon paper to become charged as well. As the document is examined, any latent impressions on the paper will cause the carbon paper to be displaced, creating a visible shadow or trace on the surface of the transparent plate. These traces can be used to visualize and analyze the latent impressions on the document, and may provide valuable information about the contents or history of the document” (RESP6/7/2023)

An Electrostatic Detection Apparatus (ESDA) provides forensic document examiners with a nondestructive method to examine indented writing on questioned documents. In this work, an ESDA is used for visualizing indentations on a piece of paper created by the act of writing on an overlying paper (such as commonly occurs when writing on a notepad), to detect latent physical markings left on documents by printers and photocopiers.

ESDA works by applying an electric charge to a document containing suspected indented writing. The indented writing is visualized through the application of charge sensitive toner. Indented writing, for instance, disturbed fibers, created from previously written documents on overlying pages can then be seen. In some cases, this method can be applied to develop fingerprints on documents.

Examinations of printed documents that involve the chemical analysis of ink colorants and the identification of physical machine defects such as trash marks are essential for the forensic examiner. But new techniques are needed to more closely identify a machine model or group of models. An electrostatic detection apparatus (ESDA) (Fig 10 below) provides forensic document examiners with indisputable method to examine and identify such machine model.



Source: Field Data (2023)

Fig 10: An Electrostatic Detection Apparatus (ESDA)

An ESDA, is also sensitive to the writings that were created many years back because of which indentations were made. It is used to visualize indented writings, which are a type of evidence which may be encountered during questioned document analysis in the cases of ransom note and extortion letters.

Indented writings are a writing that are formed to a sheet of paper underneath the one on which the original writing was done. For example, if someone writes something on the top sheet of a notepad, the pressure exerted by the pen or pencil is sufficient to

indent the papers beneath. Indented writings are the partially visible depressions on a sheet of paper that was underneath the one on which the visible writing was made while it was being written on. Such depressions are formed due to the application of pressure by the writing instrument during the process of writing. For example, the indented writing would appear as a carbon copy of the top sheet if carbon paper has been inserted between the pages.

Indented writings have proved to be valuable evidence in some cases during investigation. For example, the top sheet of a bookmaker's records may have been removed and destroyed, but it is still possible to determine what was written on the sheet by the impressions left on the pad. These impressions may contain convicting evidences supporting the charge of illegal gambling activities, etc. When paper is studied under oblique or side lighting, its indented impressions are often visible and readable. Zampa, *et al* (2021) [21] had observed that, ESDA could act as a useful screening tool in indented writings visualization. Therefore, they concluded that, as a general procedure, it is highly recommended to acquire potential indented writings visualization developed by means of ESDA before proceeding with fingerprint visualization.

In the cheque forgery category, a possibility of cheque book in the hands of fraudsters can be there. The person can forge the signature on cheque and withdraw the money. In such a case the forensic document examiners can check a second cheque for any indentations present. In the traced forgery category, it can be done by tracing signature or handwriting impressed on second page. The forger will follow the pattern of indentation of signature or handwriting to forge the signature or handwriting of someone. In this case deciphering of traced forgery can be done using ESDA.

As for the ransom note, existence can be determined from the source of indentations by deciphering it on another piece of paper (culprit's notepad) in case written. And on an anonymous letter it may bear impressions of writings that relate to some everyday activity of the offender which can ultimately lead an investigator to a particular suspect.

Forensic document examination tools that are used to conduct land fraud investigation, are moderated by Section 107 of the Evidence Act [18] which intervenes on how they are able to influence conduct land fraud investigation. Pursuant to section 107 of the Evidence Act [18], the burden of proof lies on he who asserts the existence of facts, which a document forensic examiner has to extract using the various tool as highlighted in this section. The burden of proving that a document or signature is fake or real therefore lays on the victim who has already sought the expertise of the document forensic examination department. The victim ought to show that the documents used are fake or real in that they are to deprive the victim of their property.

4. Findings

The Research results indicated that, magnifiers and microscopes were the most used tool followed by comparison devices. Third, was Ultraviolet (UV) and infrared (IR) lamp and the least was electrostatic detection apparatus. The study concluded that magnifiers and microscopes was appreciated by most of the forensic document examiners as they are the first line of examining tool for books, newspapers, checking a tag or a map, sale agreement, log books or title deeds. They, therefore, significantly influence land fraud investigation. They are the foundation of great advancement in science and indispensable in forensic investigation, especially in forensics and investigations. Handheld magnifiers come in handy for simple tasks like reading fine prints and scrutinize faded or unclear writings on documents. And they are of different types to provide different properties and aids. The most common ones are the handheld magnifying glass (called a hand lens in laboratory contexts) and the desktop magnifiers commonly known as Microscopes.

The study found out that, comparison devices is driven by the sustained need to determine whether two documents were written by the same person or for identifying differences between handwriting samples and make conclusions on the observations. The high usage of the comparison devices is due to fact that most

documents will be subjected for originality assessment. They are used to compare handwriting, printing, or other types of written marks, such as signatures or symbols. The most common one is the video spectral comparator (VSC) is a type of forensic document examination tool that is used to compare the spectral (shade) characteristics of two samples of handwriting or other written materials in order to determine whether they were written by the same person.

The study found out that the ultraviolet (UV) and infrared (IR) lamps used to scan a document for evidence not detectable by the naked eye. Documents alterations, where original script has been tampered with for instance with inks, it helps in visualizing the differences seemingly identical to the naked eye. Also, dyes and other pigments brightness when exposed to infrared stimulation may be identified by their degree of luminescence. Therefore, forensic document examiners can reveal the writing in case of chemical erasures. The use of UV and IR lamps may be useful in helping examiners to differentiate the original writing from the covering material as well.

5. Conclusion

The study concluded that, electrostatic detection apparatus (ESDA) tools are is not so much used by the forensic document examiners due to its use in the cases of traced forgery, ransom note and extortion letters. It is used for visualizing indentations on a piece of paper created by the act of writing on an overlying paper (such as commonly occurs when writing on a notepad), to detect latent physical markings left on documents by printers and photocopiers. Indented writings have proved to be valuable evidence in some cases during investigation.

This study concludes that the four forensic document examination tools: magnifiers and microscopes, comparison devices, Ultraviolet (UV) and infrared (IR) lamp and lastly, electrostatic detection apparatus, are used in the land fraud investigation at the DCI headquarters in Nairobi City County, Kenya. Through this tools, forensic document examination increases the confidence by both the victims and suspects in the land fraud investigation by the police service, aids in the speedy and fast-tracked land fraud investigation by the Police Service, and assists in the increased budget for procurement and adequate servicing of forensic tools for fraud investigation by the police service which not only discourages fraud activities but also affords a safe environment conducive for ownership and development despite the limitations and challenges the department faces.

6. Recommendations

Based on the conclusions, the study recommends that, there should be efforts to increase the usage of the forensic document examination tools. The increased usage of the service would greatly add to the improvement of the contribution of forensic document examination to boost land fraud investigation. Forensic document examiners, therefore, have to be extensively trained and undergo more developmental courses on the usage and maintenance of these tools.

7. Further Research

Based on the scope and the findings for this study, the following is the recommendation for future research: The research limited itself to the forensic document examination tools in Nairobi City County. However, a number of similarities in the practice were noted, especially through literature. It would be useful to extend this study to other counties, to determine to what extent the findings are applicable in Kenya.

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